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Title: **Energy Efficient Cloud Control and Pricing in Geographically Distributed Data Centers**

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Cloud computing has emerged as a popular paradigm where resources like virtual machines are provided as a scalable, on-demand service. The energy consumption of data centers hosting the cloud's hardware infrastructure is becoming a global environmental and cost problem, constituting 1.5% of global electricity usage. Furthermore, modern cloud providers are operating multiple geographically distributed data centers, affected by dynamic electricity prices and temperatures that we call geotemporal inputs and new pricing policies depend on the quality of service (QoS). Thus, balancing energy savings with performance and revenue losses is a challenging problem for cloud providers. Existing cloud control methods are suitable for a single data center or do not consider all available cloud control actions for energy cost reduction in geographically distributed data centers.

In this thesis, we propose a pervasive cloud control approach for dynamic resource reallocation and hardware configuration adapted to volatile geotemporal inputs. Our methods consider the QoS impact of cloud control actions and the data quality limits of time series forecasting methods. We offer a cloud controller design that supports future extensions with new decision support components. We also propose novel pricing schemes which account for computational resource availability and costs, facilitating both energy-aware and high performance cloud computing.

We evaluate our methods empirically and in simulations using historical traces of electricity prices, temperatures, workloads and other data. Our results show that significant energy cost savings are possible without harming the QoS or service revenue and our parameter exploration offers guidelines for geographically distributed cloud computing.

Yours sincerely,

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